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Date: November 15, 2000

Docket No.: 3659-0101P

BOX PATENT APPLICATION

Assistant Commissioner for Patents
Washington, DC 20231

Sir:

Transmitted herewith for filing is the patent application of

Inventor(s): Wen-Han LIU

For: METHOD OF PRODUCING WORKPIECE HAVING IRREGULAR CROSS SECTION
BY STAMPING THIN PLATE INTO THICK PLATE

Enclosed are:

- ☒ A specification consisting of eighteen (18) pages
- ☒ Nine (9) sheet(s) formal drawings
- ☒ An assignment of the invention
- ☒ Applicant claims small entity status in accordance with 37 C.F.R. § 1.27
- ☒ Certified copy of Priority Document(s)
- ☒ Executed Declaration (☒ Original ☐ Photocopy)
- ☐ Application Data Sheet in accordance with 37 C.F.R. § 1.76
- ☐ Preliminary Amendment
- ☐ Information Disclosure Statement, PTO-1449 and reference(s)

JC921 U.S. PTO
09/712253
11/15/00

- ☐ Other:
- ☐ Applicant requests early publication

The filing fee has been calculated as shown below:

			LARGE ENTITY	SMALL ENTITY
BASIC FEE			\$710.00	\$355.00
	NUMBER FILED	NUMBER EXTRA	RATE FEE	RATE FEE
TOTAL CLAIMS	8- 20 =	0	X 18 = \$0.00	x 9 = \$0.00
INDEPENDENT CLAIMS	1- 3 =	0	x 80 = \$0.00	x 40 = \$0.00
<input type="checkbox"/> MULTIPLE DEPENDENT CLAIMS PRESENTED			+ \$270.00	+ \$135.00
TOTAL			\$0.00	\$355.00

- ☒ A check in the amount of \$395.00 to cover the filing fee and recording fee (if applicable) is enclosed.
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Attachments

(REV. 11/02/2000)

STATEMENT CLAIMING SMALL ENTITY STATUS
(37 CFR 1.9(f) & 1.27(c)) - SMALL BUSINESS CONCERN

Docket Number: 3659-0101P

Applicant, Patentee, or Identifier: RULONG PRECISION INDUSTRY CO., LTD.

Application or Patent No.: New

Filed or Issued: November 15, 2000

Title: Method of Producing Workpiece Having Irregular Cross Section by Stamping Thin Plate

I hereby state that I am

into Thick Plate

- ☐ the owner of the small business concern identified below:
☒ an official of the small business concern empowered to act on behalf of the concern identified below:

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NAME OF PERSON SIGNING Liu, Wen-Han

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SIGNATURE Liu, Wen-Han DATE Oct. 15, 2000

C.

METHOD OF PRODUCING WORKPIECE HAVING IRREGULAR CROSS
SECTION BY STAMPING THIN PLATE INTO THICK PLATE

BACKGROUND OF THE INVENTION

5

The present invention relates to a method of producing
workpiece having irregular cross section, and more
particularly to a method of producing workpiece having
irregular cross section by stamping a thin plate into a
10 thick plate. In the method, predetermined scrap areas
on the thin plate are continuously stamped so that some
parts of these scrap areas are compressed and pushed
toward non-continuous specific areas on the thin plate
for forming thicker areas on the workpiece.

15

A conventional connecting terminal as shown in Fig. 1,
or a contact element in a connector, or a contact element
in a relay will frequently come into contact with other
elements when the terminal, the connector or the relay
20 is in use. It is a common practice to increase the
thickness of the areas of such connecting terminal or
contact element that are frequently contacted with other
elements, so that the terminal or the connector or the
relay may have longer useable life or higher wear
25 resistance. Such element having areas of different

thickness is usually referred to as the workpiece having irregular cross section.

In a conventional method for producing the above-
5 described workpiece having irregular cross section, a plate having a uniform thickness T corresponding to a largest thickness to be formed on the workpiece is selected for use. Areas on the plate that are to be thinned for forming thinner areas on the workpiece are
10 fabricated by milling, as shown in Fig. 2, to obtain a desired thickness t . Thereafter, the milled plate is further rolled or ground to provide a plate having the desired irregular cross section as that to be formed on the workpiece. The plate is then stamped to obtain the
15 workpiece having a desired profile and the desired irregular cross section.

In the process of milling the plate to obtain the desired irregular cross section, high temperature tends to occur
20 at the surface being milled and results in changes of the physical properties of the plate, such as uneven thickness or varied hardness. Such changes in physical properties frequently cause unexpected changes in the thickness of the milled plate and accordingly, difficulties in
25 subsequent stable fabrication of the plate. Moreover,

the plate selected for use has an initial thickness corresponding to that for the thickest area on the complete workpiece. A large part of the thick plate is milled to meet the thickness for the thinner areas to be
5 formed on the complete workpiece and therefore unnecessarily produces a large amount of scraps. Burrs and warps also tend to occur at ends and edges of the milled surfaces to cause poor quality of the produced workpiece. In the event the workpiece has discontinuous thicker areas,
10 such milling process must be locally proceeded at such thicker areas one by one and the tool used to mill the plate must be differently adjusted for each area to obtain the desired stepped surface of the workpiece. Such milling process is time consuming and increases the
15 manufacturing cost thereof and it is impossible to proceed the milling at different stages in an automated manner.

SUMMARY OF THE INVENTION

20 It is therefore a primary object of the present invention to provide a method of producing a workpiece having irregular cross section by stamping a thin plate into a thick plate. In this method, a plate having a uniform thickness corresponding to a smallest thickness to be
25 formed on the workpiece is used, so that cost and time

that is otherwise needed to mill the plate can be saved and scrap that would be produced in the stamping is largely reduced to lower the manufacturing cost of the workpiece.

- 5 To achieve the above and other objects of the present invention, there is provided a method of producing a workpiece having irregular cross section, in which a thin plate having a uniform thickness corresponding to that of a thinner area to be formed on the workpiece is used.
- 10 Multiple stamping heads having different and gradually increased bevel angles are used one by one to stamp one or two sides of the thin plate at predetermined scrap areas, so that parts of the scrap areas are gradually compressed and pushed toward specific areas that are to have a larger
- 15 thickness on the workpiece. When the specific areas bump to a predetermined height through continuous stamping of the scrap areas, stamping molds are used to downward stamp the bumped areas into a predetermined shape. Thereafter, the remained scrap areas on the thin plate are removed
- 20 to obtain the desired workpiece. With the method of the present invention, thickness of the workpiece at different areas can be precisely controlled and the producing of a workpiece having discontinuous thicker areas can be achieved through automated fabrication
- 25 processes. The method also enables largely reduced scrap

and manufacturing time and cost in forming the workpiece having irregular cross section.

BRIEF DESCRIPTION OF THE DRAWINGS

5 The structure and the technical means adopted by the present invention to achieve the above and other objects can be best understood by referring to the following detailed description of the preferred embodiments and the accompanying drawings, wherein

10

Fig. 1 is a perspective of a general workpiece having irregular cross section;

Fig. 2 schematically shows the manner of thinning a thick
15 plate through milling;

Fig. 3 is a perspective of a workpiece having irregular cross section produced with the method of the present invention;

20

Fig. 4 is a cross sectional view showing the first step of the method of the present invention to produce a workpiece having irregular cross section;

25 Fig. 5 is a cross sectional view showing the second step

of the method of the present invention;

Fig. 6 is a cross sectional view showing the third step of the method of the present invention;

5

Fig. 7 is a cross sectional view showing the employment of the first step of the method of the present invention in producing the workpiece having irregular cross section;

10

Fig. 8 is a cross sectional view showing the employment of the second step of the method of the present invention in producing the workpiece having irregular cross section;

15

Fig. 9 is a cross sectional view showing the employment of the third step of the method of the present invention in producing the workpiece having irregular cross section;

20

Fig. 10 is a cross sectional view showing the fourth step of the method of the present invention, wherein a stamping mold has not been stamped onto the half-finished workpiece;

25

Fig. 11 is another cross sectional view showing the fourth step of the method of the present invention, wherein the stamping mold has been stamped onto the half-finished workpiece;

5

Fig. 12 shows a series of continuous movements of the fourth step of the method of the present invention in producing the workpiece having irregular cross section;

10 Figs. 13 to 15 illustrate another manner of using the method of the present invention to produce a workpiece having irregular cross section;

Fig. 16 shows the use of a stamping mold to stamp the
15 half-finished workpiece produced in Figs. 13 to 15; and

Fig. 17 is a cross sectional view showing a further manner of using the method of the present invention to produce a workpiece having irregular cross section.

20

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Please refer to Fig. 3 that shows an example of a workpiece 1 having irregular cross section that could be produced
25 with the method of the present invention. In this method,

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a thin plate 2 having a uniform thickness corresponding to that of a thinner area 1a to be formed on the workpiece 1 is used, as shown in Fig. 4. After the thin plate 2 is selected, the workpiece 1 is produced in the following 5 steps:

Step 1: Securely position the thin plate 2 in a mold cavity 3. Prepare a series of sequentially arranged stamping heads above the thin plate. Use a first stamping head 10 4 having a first bevel surface 41 to stamp one side of the thin plate 2 at a predetermined scrap area 1b that is eventually to be removed from the thin plate 2. Control the first stamping head 4 so that the stamped scrap area 1b is gradually compressed and pushed toward an area 1c 15 that is to form an area on the workpiece 1 having a larger thickness. The stamping is continued until the area 1c bumps to a predetermined height or thickness.

Step 2: As shown in Fig. 5, the thin plate 2 in the mold 20 cavity 3 is transferred via an automatic conveyer (not shown) to a position below a second stamping head 4a having a second bevel surface 41a that has a bevel angle larger than that of the first bevel surface 41. Use the second stamping head 4a to stamp the plate 2 further at the 25 predetermined scrap area 1b, so that the second bevel

surface 41a compresses and pushes more part of the scrap area 1b toward a center of the already bumped area 1c, making the bumped area 1c to be even higher.

5 Step 3: As shown in Fig. 6, the thin plate 2 in the mold cavity 3 past the second step is transferred to locate below a third stamping head 4b having a third bevel surface 41b that has a bevel angle larger than that of the first and the second bevel surfaces 41, 41a. When the third
10 stamping head 4b is used to downward stamps the plate 2 further at the scrap area 1b, the third bevel surface 41b compresses and pushes more part of the scrap area 1b toward a center of the highly bumped area 1c, so that the area 1c reaches a predetermined height or thickness.

15 Step 4: As shown in Figs. 7 to 9, the above-described steps 1 to 3 are sequentially repeated on the plate 2 at other predetermined scrap areas 1b, so that parts at these scrap areas 1b are compressed and pushed toward the center of
20 the predetermined area 1c for the latter to bump higher and reach the predetermined height or thickness. At this point, a stamping mold 5 is used to downward stamp the bumped area 1c, as shown in Figs. 10 and 11, so that the bumped area 1c is molded into a shape intended for the
25 thicker area 1c on the workpiece 1, as shown in Fig. 12.

Finally, remove the remaining scrap areas 1b on the plate 2 according to the predetermined configuration for the workpiece 1, so that the workpiece 1 having desired irregular cross section shown in Fig. 3 is obtained.

5

The above-described method has the following advantages:

1. It is possible to produce the workpiece 1 having irregular cross section depending on particular requirements set for the workpiece 1, so that specific configuration and thickness could be formed at specified area as required.
2. The thickness for any specific area on the workpiece 1 could be precisely controlled in stamping the plate 2.
3. In the event the workpiece 1 having irregular cross section has thicker areas that are not continuously arranged on the workpiece 1, such discontinuous thicker areas could still be obtained through automated fabrication of stamping to largely simplify the manufacturing process and reduce the manufacturing time that is otherwise needed in the conventional milling process.

25

4. The amount of scrap could be largely reduced to effectively lower the manufacturing cost.

5 Figs. 13 to 15 illustrate another manner of using the method of the present invention to produce a workpiece having irregular cross section. In this case, two stamping heads 4 are separately positioned above and below the thin plate 2 at places decided by areas 1c that are to be thicker than other areas on the workpiece 1. The
10 stamping heads 4 may be particularly designed and formed depending on the distribution of the thicker areas 1c on two sides of the workpiece 1, so that stamping of the thin plate 2 at two different positions from two sides of the plate 2 may be synchronously proceeded. In the
15 above-mentioned two-position two-side stamping, the steps 1, 2, 3 and 4 of the method of the present invention are sequentially employed with the stamping heads 4, 4a and 4b arranged in series to work at the predetermined scrap areas 1b step by step, so that parts of the scrap
20 areas 1b are gradually compressed and pushed toward centers of the predetermined thicker areas 1c for the latter to reach the predetermined thickness. Thereafter, upper and lower stamping molds 5 are used at the same time to stamp the thicker areas 1c into the desired
25 configuration, as shown in Fig. 16. Finally, the remained

scrap areas 1b are removed according to the predetermined profile of the workpiece 1, so that the workpiece 1 as shown in Fig. 3 could be obtained.

5 In actual use or assembling of the workpiece 1 having irregular cross section, it is possible that two adjacent workpieces 1 are to be staggered and located in opposite directions. In this case, it is necessary to stagger areas on a continuous long plate 2 for formed workpieces
10 1 to stagger at upper and lower sides of the plate 2. By controlling intervals between the stamping heads 4, 4a and 4b and time for conveying the plate 2, the steps of the method of the present invention may be implemented at two sides of the plate 2 at the same time, as shown
15 in Fig. 17, so that two adjacent and staggered workpieces 1 could be completed synchronously in the same one conveyance of the plate 2. In this manner, the whole manufacturing process for forming the workpiece 1 could be completed at shortened time and increased productivity
20 to largely reduce the manufacturing cost thereof.

The stamping mold 5 is designed according to the profile of the thicker areas 1c to be formed on the workpiece 1. An interior of the stamping mold 5 may be of any shape
25 as long as it could stamp the bumped area 1c into the

desired configuration. It is apparent that many changes and modifications in the internal geometric shape of the stamping mold 5 can be carried out without departing from the scope and the spirit of the invention.

What is claimed is:

1. A method of producing workpiece having irregular cross section by stamping thin plate into thick plate, in which a thin plate having a uniform thickness corresponding to that of a thinner area to be formed on said workpiece is used, said method comprising the following steps: securely positioning said thin plate in a mold cavity; preparing a series of sequentially arranged stamping heads having respective bevel surfaces of different bevel angles, so that said stamping heads could be sequentially shifted to align with a predetermined scrap area on said thin plate; using said stamping heads one by one to stamp said thin plate at said predetermined scrap area so that a part of said scrap area is gradually compressed and pushed toward a specific area that is to have larger thickness on said workpiece; keeping stamping said scrap area with said stamping heads having increased bevel angles until said specific area to have larger thickness bumps and reaches a predetermined thickness; using a stamping mold to downward stamp said bumped area into a predetermined shape; and stamping off said scrap area that has been partially stamped and thinned and other unused areas on said thin plate according to a

configuration preset for said workpiece; whereby said workpiece could be fabricated through automated stamping processes to have thicker areas discontinuously distributed thereon at largely
5 reduced scrap and manufacturing cost.

2. A method of producing workpiece having irregular cross section by stamping thin plate into thick plate as claimed in claim 1, wherein said stamping heads are
10 located at one side of said thin plate.

3. A method of producing workpiece having irregular cross section by stamping thin plate into thick plate as claimed in claim 1, wherein said stamping heads are
15 located at upper and lower sides of said thin plate and are formed depending on a predetermined distribution manner of said thicker areas on said workpiece to compress and push said scrap area from upper and lower sides thereof and at two corresponding
20 positions.

4. A method of producing workpiece having irregular cross section by stamping thin plate into thick plate as claimed in claim 1, wherein said stamping heads are
25 staggered at upper and lower sides of said thin plate

to achieve synchronous manufacturing of two adjacent workpieces from two sides of said thin plate through controlling of intervals between two adjacent stamping heads at two sides of said thin plate and time for stamping said scrap area on said thin plate.

5. A method of producing workpiece having irregular cross section by stamping thin plate into thick plate as claimed in claim 2, wherein said stamping heads are sequentially used to stamp said scrap area from the one having a smallest bevel angle to the one having a largest bevel angle.

6. A method of producing workpiece having irregular cross section by stamping thin plate into thick plate as claimed in claim 3, wherein said stamping heads are sequentially used to stamp said scrap area from the one having a smallest bevel angle to the one having a largest bevel angle.

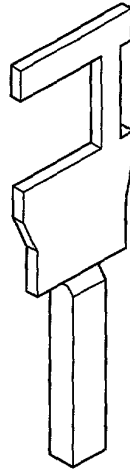
7. A method of producing workpiece having irregular cross section by stamping thin plate into thick plate as claimed in claim 4, wherein said stamping heads are sequentially used to stamp said scrap area from the one having a smallest bevel angle to the one having

a largest bevel angle.

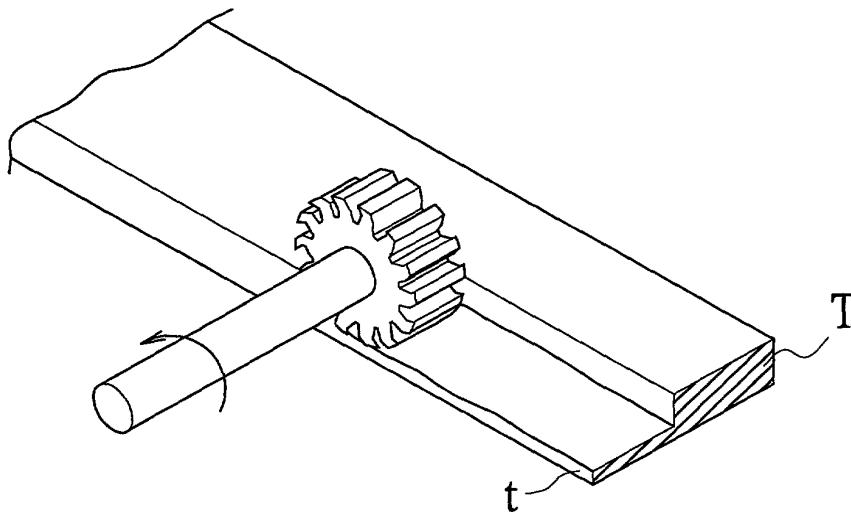
8. A method of producing workpiece having irregular cross
section by stamping thin plate into thick plate as
claimed in claim 1, wherein said stamping mold may be
5 of any internal configuration that is determined
completely depending on a profile of said thicker area
to be formed on said workpiece.

ABSTRACT OF THE DISCLOSURE

A method of producing workpiece having irregular cross section by stamping thin plate into thick plate is provided. In the method, a thin plate having a uniform thickness corresponding to that of a thinner area to be formed on the workpiece is used. Multiple stamping heads having different and gradually increased bevel angles are used one by one to stamp one or two sides of the thin plate at a predetermined scrap area, so that a part of the scrap area is gradually compressed and pushed toward a specific area that is to have larger thickness on said workpiece. When the specific area bumps to a predetermined height, a stamping mold is used to downward stamp the bumped area into a predetermined shape. Thereafter, the remained scrap area on the thin plate is removed to obtain the desired workpiece. The method enables largely reduced scrap and manufacturing time and cost in forming a workpiece having irregular cross section.



(PRIOR ART)
Fig.1



(PRIOR ART)
Fig.2

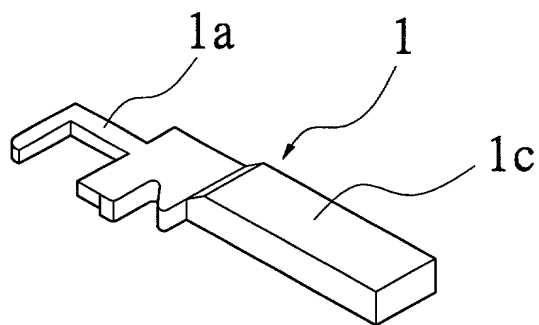


Fig.3

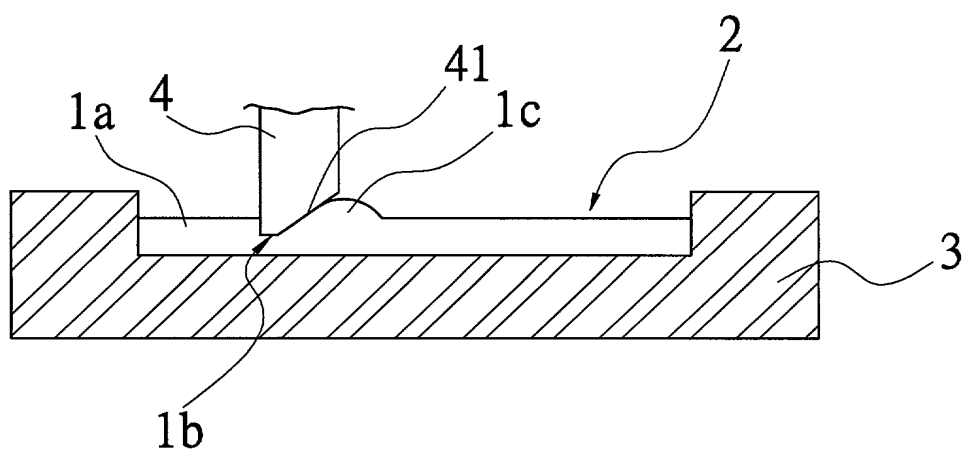


Fig.4

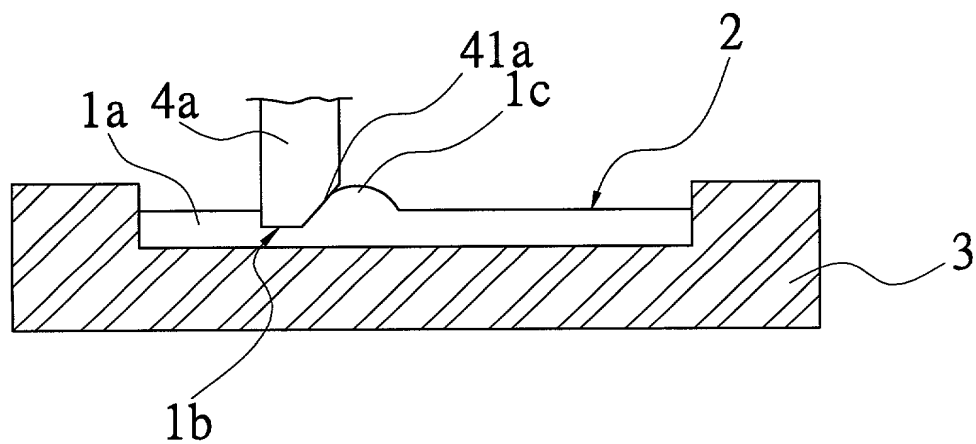


Fig.5

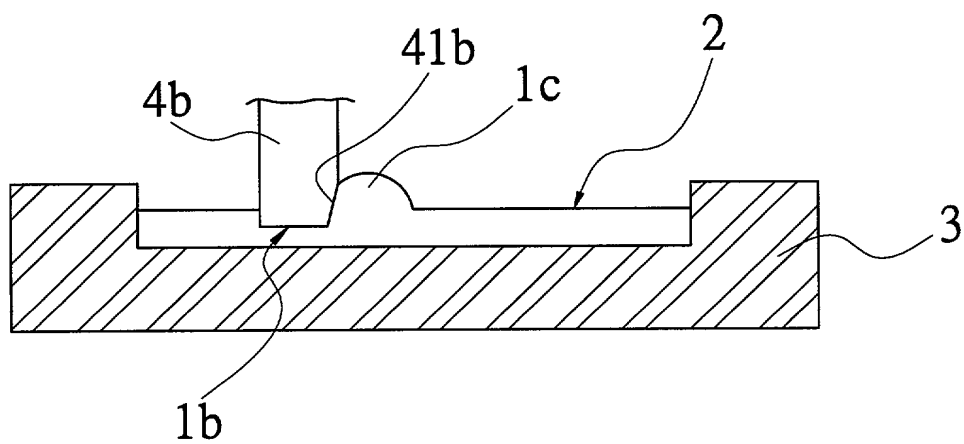


Fig.6

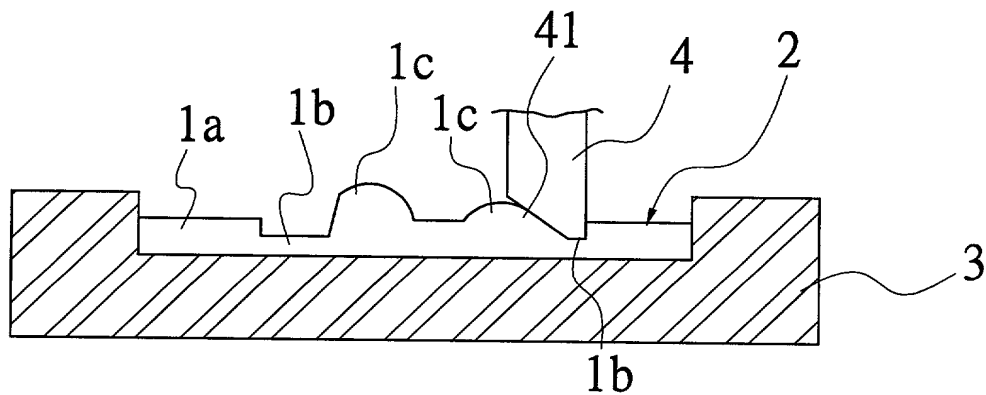


Fig.7

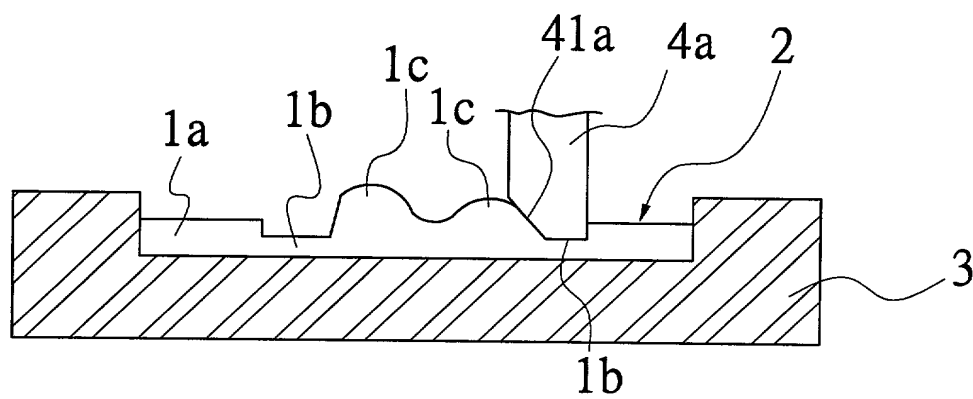


Fig.8

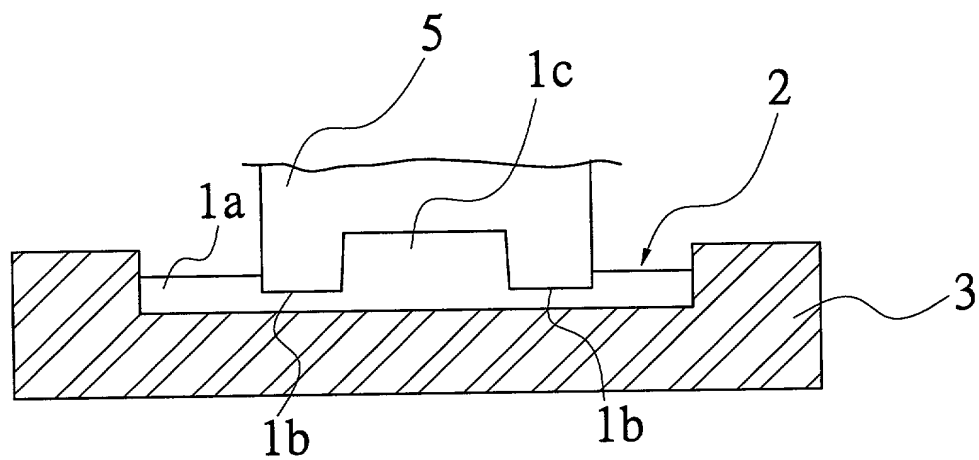


Fig.11

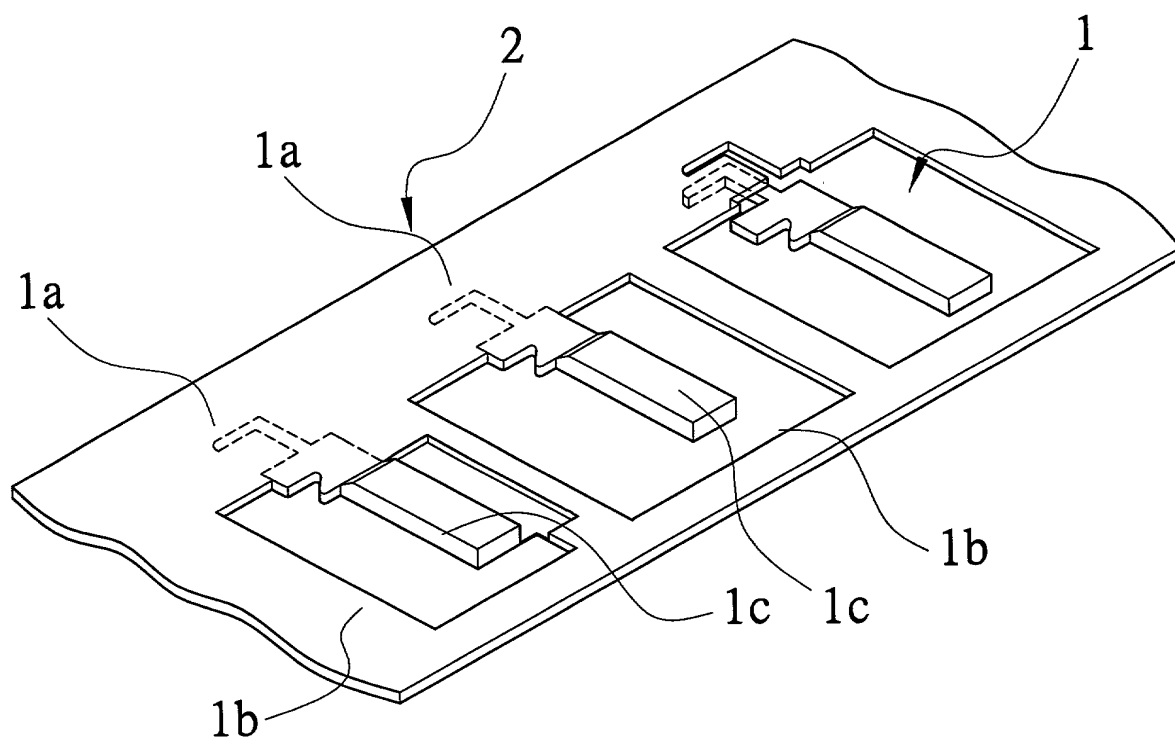


Fig.12

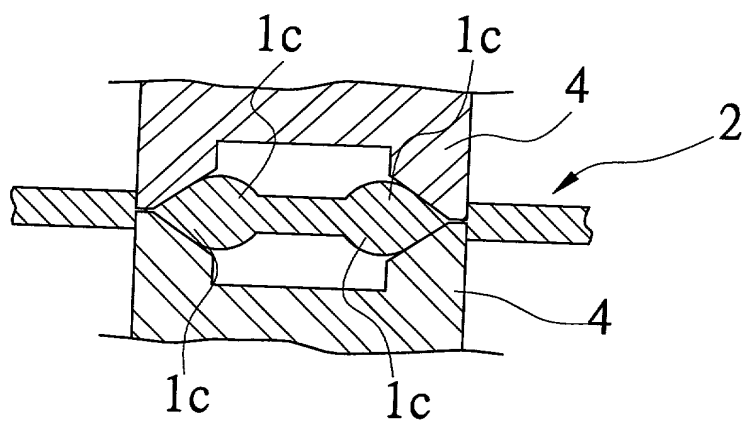


Fig.13

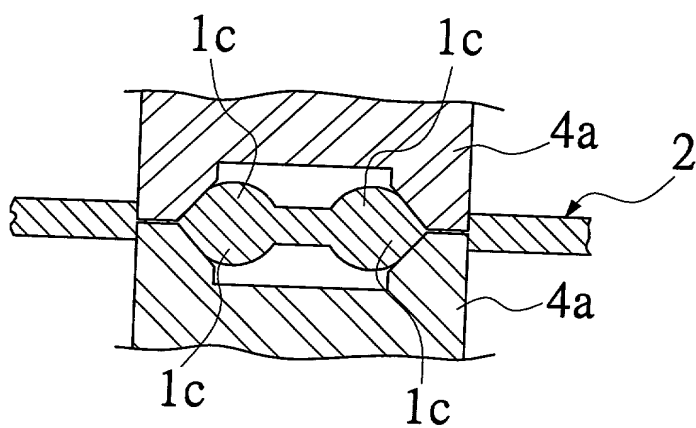


Fig.14

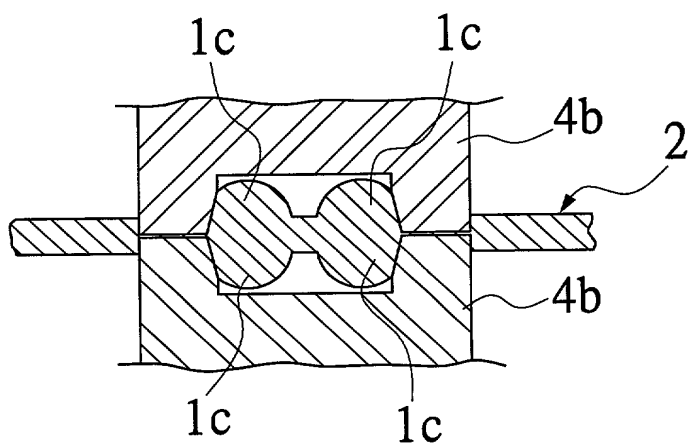


Fig.15

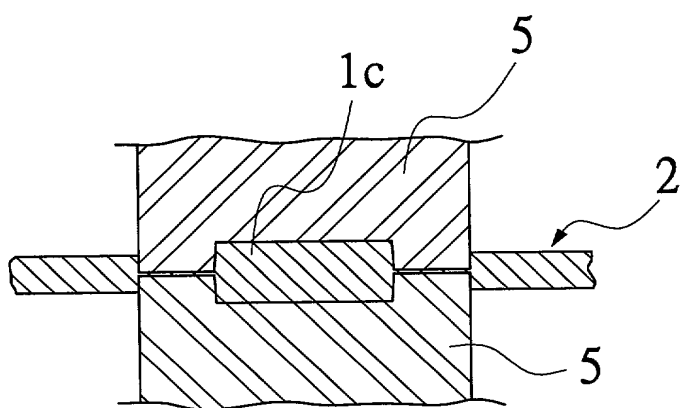


Fig.16

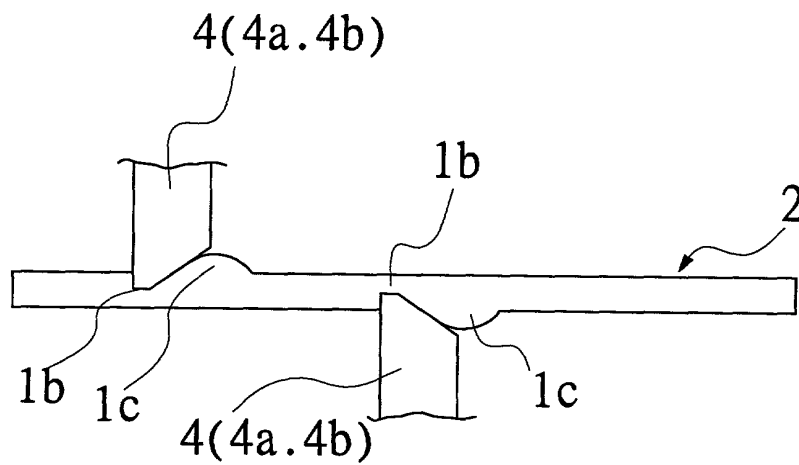


Fig.17

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3659-0101P

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Insert Title: Method of Producing Workpiece Having Irregular Cross Section by Stamping Thin Plate into Thick Plate

Fill in Appropriate Information - For Use Without Specification Attached:
the specification of which is attached hereto. If not attached hereto, _____ as the specification was filed on _____ as United States Application Number _____; and amended on _____ (if applicable) and/or the specification was filed on _____ as PCT International Application Number _____; and was amended under PCT Article 19 on _____ (if applicable)

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, §1.56.

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Prior Foreign Application(s)			Priority Claimed	
<u>089120496</u>	<u>Taiwan</u>	<u>10/ 02/2000</u>	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No
(Number)	(Country)	(Month/Day/Year Filed)		
<u> </u>	<u> </u>	<u> </u>	<input type="checkbox"/> Yes	<input type="checkbox"/> No
(Number)	(Country)	(Month/Day/Year Filed)		
<u> </u>	<u> </u>	<u> </u>	<input type="checkbox"/> Yes	<input type="checkbox"/> No
(Number)	(Country)	(Month/Day/Year Filed)		
<u> </u>	<u> </u>	<u> </u>	<input type="checkbox"/> Yes	<input type="checkbox"/> No
(Number)	(Country)	(Month/Day/Year Filed)		

I hereby claim the benefit under Title 35, United States Code, §119(e) of any United States provisional applications(s) listed below.

<u> </u>	<u> </u>
(Application Number)	(Filing Date)
<u> </u>	<u> </u>
(Application Number)	(Filing Date)

All Foreign Applications, if any, for any Patent or Inventor's Certificate Filed More than 12 Months (6 Months for Designs) Prior to the Filing Date of This Application:

Country	Application Number	Date of Filing (Month/Day/Year)
<u> </u>	<u> </u>	<u> </u>
<u> </u>	<u> </u>	<u> </u>

I hereby claim the benefit under Title 35, United States Code, §120 of any United States and/or PCT application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States and/or PCT application in the manner provided by the first paragraph of Title 35, United States Code, §112, I acknowledge the duty to disclose information which is material to the patentability as defined in Title 37, Code of Federal Regulations, §1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application.

<u> </u>	<u> </u>	<u> </u>
(Application Number)	(Filing Date)	(Status - patented, pending, abandoned)
<u> </u>	<u> </u>	<u> </u>
(Application Number)	(Filing Date)	(Status - patented, pending, abandoned)

Insert Prior U.S.
Application(s):
(if any)

I hereby appoint the following attorneys to prosecute this application and/or an international application based on this application and to transact all business in the Patent and Trademark Office connected therewith and in connection with the resulting patent based on instructions received from the entity who first sent the application papers to the attorneys identified below, unless the inventor(s) or assignee provides said attorneys with a written notice to the contrary:

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**PLEASE
NOTE:
YOU MUST
COMPLETE
THE
FOLLOWING:**

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

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GIVEN NAME/FAMILY NAME		INVENTOR'S SIGNATURE	DATE*
Residence (City, State & Country)		CITIZENSHIP	
POST OFFICE ADDRESS (Complete Street Address including City, State & Country)			
GIVEN NAME/FAMILY NAME		INVENTOR'S SIGNATURE	DATE*
Residence (City, State & Country)		CITIZENSHIP	
POST OFFICE ADDRESS (Complete Street Address including City, State & Country)			
GIVEN NAME/FAMILY NAME		INVENTOR'S SIGNATURE	DATE*
Residence (City, State & Country)		CITIZENSHIP	
POST OFFICE ADDRESS (Complete Street Address including City, State & Country)			

*DATE OF SIGNATURE